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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/509,935

Applicant(s)

SARICIFTCI ET AL.

Examiner

MIRIAM BERDICHEVSKY

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 12-20 and 22-24 is/are pending in the application.
- 4a) Of the above claim(s) 11 and 21 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10, 12-20 and 22-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/888)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

Applicant's amendment of May 2, 2008 does not render the application allowable.

Status of Objections and Rejections

The objection to the claims has been withdrawn in view of Applicant's amendment.

The rejection of claims 12 and 21 is obviated by Applicant's cancellation.

The rejections of claims 1-9 from the previous office action are maintained.

All other rejections from the previous office action are withdrawn in view of Applicant's arguments. New grounds of rejection under 35 U.S.C. 103(a) are necessitated by the amendments.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1-10, 12-20 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cravino in view of Sentein and further in view of Zhao.

As to claims 1, 10, 19 and 24, Cravino teaches a photovoltaic cell comprising,

- A photoactive region and two metal electrodes (p-type/n-type between anode and cathode, Figure 1),
- The photoactive layer comprising a conjugated polymer component (electron donor) and a fullerene component (electron acceptor) (section 5, ¶ 1), and
- The two metal electrodes provided on either side of the photoactive layer (p- type/n-type between anode and cathode, Figure 1).

Cravino is silent to a method for the post treatment of a photovoltaic cell comprising:

- Subjecting the photovoltaic cell to heat treatment above a glass transition temperature of the conjugated polymer for a predetermined treatment time,
- The heat treatment of the photovoltaic cell being carried out for at least a portion of the treatment time under the influence of an electric field induced by a field voltage applied to the electrodes of the photovoltaic cell and exceeding a no-load voltage thereof.

Sentein teaches a method for the post treatment of a photovoltaic cell comprising:

- Subjecting the photovoltaic cell to heat treatment near a glass transition temperature of the conjugated polymer for a predetermined treatment time (section 1, ¶ 2),
- The heat treatment of the photovoltaic cell being carried out for at least a portion of the treatment time under the influence of an electric field induced by a field voltage applied to the electrodes of the photovoltaic cell and exceeding a no-load voltage thereof (section 1, ¶ 2; section 5, ¶ 1).

Where 5 to 10 V clearly exceeds a no-load voltage.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the fullerene/polymer system of Sentein in Carvino because fullerenes have an extended delocalised π -electron source and lead to the cost effective fabrication of flexible large area solar cells, as taught by Sentein (section 1, ¶ 1).

Neither Cravino nor Sentein teach the heat treatment being above a glass transition temperature of the conjugated polymer.

Zhao teaches a heat treatment being above a glass transition temperature (T_g) of the conjugated polymer (Results section, ¶ 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Cravino and Sentein by increasing the heating temperature to above the T_g of the conjugated polymer as taught by Zhao because a higher crystallization can be obtained at higher crystallization temperatures, as taught by Zhao (Results section, ¶ 4), thus higher crystallization as a result of rectification of the polymer molecules reduces potential barriers for extraction of electricity at the

electrode, as taught by Sentein (Section 5, ¶ 1). Where increased extraction results from increased electron transport through the cell due to increased cell efficiency.

Further regarding claim 19, the reference teaches applying a field voltage to the first and second electrodes and the electric field exceeds a no-load voltage of the photovoltaic cell (Sentein: section 2, ¶ 3; section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage. However, neither Cravino nor Sentein explicitly teach that the invention is subjected for between 2 and 8 min (claim 19) or between 4 and 5 min (claim 23); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 19) or between 4 and 5 minutes (claim 23) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6).

Further regarding claim 24, the reference teaches simultaneously injecting charge carriers into the photovoltaic cell via at least one electrode selected from the group consisting of the first and second electrode. Application of the field will inherently, inject charge carriers.

Regarding claim 2, modified Cravino teaches that the electric field is induced via a field voltage that exceeds the no-load voltage of the photovoltaic cell by at least 1 V (Sentein: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

Regarding claim 3, neither Cravino nor Sentein explicitly teach application of a field voltage between 2.5 and 3 V.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply a voltage between 2.5 and 3 V, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In *re Boesch*, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the current/voltage experiments were performed for a broad range of values as seen in Sentein (Figure 5).

Regarding claim 4-9, neither Cravino nor Sentein explicitly teach that the invention as to claim 1 or claim 2 or claim 3 is subjected for between 2 and 8 min (claims 4-6) or between 4 and 5 min (claims 7-9); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 17) or between 4 and 5 minutes (claims 18 and 23) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In *re Boesch*, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6).

Regarding claim 12, Cravino and Sentein are silent to heating above a glass transition temperature of the electron donor.

Zhao teaches heating above a glass transition temperature of the electron donor (conjugated polymer) (Results section, ¶ 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to increase the heating temperature to above the T_g of the conjugated polymer as done by Zhao in modified Cravino because a higher crystallization can be obtained at higher crystallization temperatures, as taught by Zhao (Results section, ¶ 4).

Regarding claim 13, the reference teaches that the electric field is formed by applying a field voltage to the first and second electrodes (Sentien: section 2, ¶ 3).

Regarding claim 14, the reference teaches that the electric field exceeds a no-load voltage of the photovoltaic cell (Sentien: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage because the open current voltage of single junction cells are typically of the order of 1 V or less.

Regarding claims 15 and 22, the reference teaches that the electric field exceeds the no-load voltage by at least 1 V (Sentien: section 5, ¶ 1). Where 5 to 10 V clearly exceeds a no-load voltage.

Regarding claim 16, Sentien suggests application of a field voltage between 2.5 and 3 V.

It would have been obvious to one of ordinary skill in the art at the time of the invention to apply a voltage between 2.5 and 3 V, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of

the fact that the current/voltage experiments were performed for a broad range of values as seen in Sentein (Figure 5).

Regarding claims 17-18 and 23, Sentein teaches that the photovoltaic cell is subjected for between 2 and 8 min (claim 17) or between 4 and 5 min (claims 18 and 23); to heat treatment under the influence of an electric field.

It would have been obvious to one of ordinary skill in the art at the time of the invention to have subjected the cell to heat treatment for between 2 and 8 minutes (claim 17) or between 4 and 5 minutes (claims 18 and 23) since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272,205 USPQ 215 (CCPA 1980), especially in light of the fact that the time scale used during experimentation is of the same order of magnitude (min) as seen in Sentein (Figure 6).

Regarding claim 20, the reference teaches that the photoactive layer comprises an electron donor and an electron acceptor (section 2, ¶ 1).

Response to Arguments

Applicant's arguments filed on have been fully considered but they are not persuasive.

In the arguments presented on page 6 of the amendment, the applicant argues:

1. that Sentein does not disclose a photovoltaic cell having two compounds in a photoactive layer. Sentein discloses a photoactive layer which has both a donor and an acceptor (page 317, section 2, paragraph 1). Claims 1-9 and as amended, claims 10-19 and 22-24 do not require two separate compounds,

emphasis on the singular "photovoltaic layer". Furthermore, given the broadest reasonable interpretation a component is considered a part of a layer.

2. Regarding claims 19, 20, 22 and 24 that Sentein does not teach heating above the T_g of the photoactive layer. The Examiner agrees however modified Cravino modified with Zhao corrects this deficiency. Zhao teaches a heat treatment being above a glass transition temperature (T_g) of the conjugated polymer (Results section, ¶ 3, "a higher crystallinity can be obtained at higher crystallization temperatures") to provide increased crystallization (order) which has the advantage of reducing potential barriers (Sentein: 5, ¶ 1).

3. In response to applicant's argument that Zhao is nonanalogous art, it has been held that a prior art reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, Zhao discusses the properties of a thiophene whose family is well known as an organic active material in photovoltaics.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

Art Unit: 4132

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

/M. B./

Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795